

**REMARKS**

**I. Status of the Claims and Summary of the Final Office Action<sup>1</sup>**

Claims 1-316 are pending and under consideration on the merits. No claims are amended or canceled herein.

**II. Response to 35 U.S.C. § 101 Rejection**

In the final Office Action dated November 18, 2008, the Office:

- rejected claims 1-316 under 35 U.S.C. § 101 for the reasons of record (final Office Action, page 2); and
- rejected claims 1-316 under 35 U.S.C. § 112, first paragraph, for the reasons of record (Id.).

Applicant respectfully continues to disagree with and traverse the Office's position for the reasons of record, as well as the following additional reasons.

According to the Office:

The inconsistency between an alleged transfer of energy from the hydrogen atom to the catalyst at an amount of 27.2 eV is based on calculation, derived from applicant's own equation that underlies his theory. Applicant's equation for the "binding energy" of a hydrogen atom is shown on page 1 of the specification, where Binding Energy =  $13.6 \text{ eV}/(1/p)^2$ , where p is an integer greater than 1. When p equals 1, the hydrogen atom is at what is conventionally known as the "ground state", and the binding energy is 13.6 eV. If p is the integer 2, the binding energy becomes  $13.6 \text{ eV}/(1/2)^2$ , or  $13.6 \text{ eV}/(1/4)$ , or  $13.6 \text{ eV} \times 4$ , or 54.4 eV. When p transitions from 1 to 2, the difference in energy is  $(54.4 - 13.6) \text{ eV}$ , or 40.8 eV. This would be  $(13.6 \times 3) \text{ eV}$ . Substituting integers higher than 2 for p, the difference between energy levels corresponding to any two values of p is greater than 40.8 eV.

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<sup>1</sup> The final Office Action contains a number of statements reflecting characterizations of the related art and the claims. Regardless of whether any such statement is identified herein, Applicant declines to automatically subscribe to any statement or characterization present in the final Office Action.

Thus, applicant's alleged catalytic transfer of energy is inconsistent with his own modeling of the hydrogen atom.

Final Office Action, pp. 3-4.

Based on this assertion and a "consolidated appendix" attached to the final Office Action, the final Office Action maintains that the claimed invention is "inoperative and therefore lacks credible utility" under 35 U.S.C. § 101. See id. As an initial matter, the issues given in the Examiner's Appendix are answered completely in Applicant's publication: R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*; June 2008 Edition, posted at: <http://www.blacklightpower.com/theory/bookdownload.shtml>

As shown in Attachment 4, Dr. Booker independently verified the values of the one-electron quantities described in Chapter 1 of Mills' *The Grand Unified Theory of Classical Quantum Mechanic*. Dr. Booker further verified the CQM value for the Lande g factor for the electron, as well as many of the equations and calculated quantities listed in Chapter 1, which is a validation of the CQM theory in Chapter 1.

**A. The utility requirement is met for the reasons of record**

Applicant respectfully disagrees with and traverses this rejection for the reasons of record. In particular, Applicant maintains that: 1) the claimed subject matter falls within the scope of patentable subject matter encompassed by 35 U.S.C. § 101; 2) the final Office Action failed to establish that the present application lacks a specific, substantial and credible utility; and 3) even if, arguendo, the Office established a prima facie case of lack of utility, the evidence of record rebuts such position by demonstrating that the claimed invention is operable. See Request for Reconsideration filed July 21,

2008, pp. 2-12. For at least these reasons, the 35 U.S.C. § 101 rejection is improper, and should be withdrawn.

**B. The Office's position as to lack of utility is flawed, because it is based upon a misinterpretation and misunderstanding of the claim language**

Applicant also disagrees with and traverses the final Office Action's position, at least because the Action's statement that "[there is] an alleged transfer of energy from the hydrogen atom to the catalyst at an amount of 27.2 eV, which is not possible for a hydrogen atom" reflects a misunderstanding and misinterpretation of the specification. See Final Office Action, pp. 2-3. The specification explains that "[a] plasma forming electrolytic power cell and hydride reactor . . . comprises," inter alia, "a catalyst capable of providing a net enthalpy of reaction of  $m / 2 \cdot 27.2 \pm 0.5$  eV where  $m$  is an integer." Specification at p. 20, lines 19-24 (emphasis added).

Applicant disagrees with and traverses the final Office Action's position, at least because the Action's statement that the energy transferred to that catalyst is necessary equal to the energy difference between the initial and final states. The reaction involves two steps involving an initial nonradiative resonant energy transfer from the hydrogen atom to the catalyst followed by the remaining energy difference between the initial and final states released spontaneously. As shown below, Applicant's position is entirely consistent with and supported by Classical Physics.

Specifically, Classical Physics gives closed-form solutions of the hydrogen atom, the hydride ion, the hydrogen molecular ion, and the hydrogen molecule and predicts corresponding species having fractional principal quantum numbers [1-12]. The nonradiative state of atomic hydrogen, which is historically called the "ground state"

forms the basis of the boundary condition of classical physics to solve the bound electron. Classical physics predicts a reaction involving a resonant, nonradiative energy transfer from otherwise stable atomic hydrogen to a catalyst capable of accepting the energy to form hydrogen in lower-energy states than previously thought possible.

Classical Physics further predicts that atomic hydrogen may undergo a catalytic reaction with certain atoms, excimers, ions, and diatomic hydrides which provide a reaction with a net enthalpy of an integer multiple of the potential energy of atomic hydrogen,

$E_h = 27.2 \text{ eV}$  where  $E_h$  is one Hartree. Specific species (e.g.  $\text{He}^+$ ,  $\text{Ar}^+$ ,  $\text{Sr}^+$ ,  $\text{K}$ ,  $\text{Li}$ ,  $\text{HCl}$ , and  $\text{NaH}$ ) identifiable on the basis of their known electron energy levels are required to be present with atomic hydrogen to catalyze the process. The reaction involves a nonradiative energy transfer followed by  $q \cdot 13.6 \text{ eV}$  continuum emission or  $q \cdot 13.6 \text{ eV}$  transfer to  $\text{H}$  to form extraordinarily hot, excited-state  $\text{H}$  and a hydrogen atom that is lower in energy than unreacted atomic hydrogen that corresponds to a fractional principal quantum number. That is, in the formula for the principal energy levels of the hydrogen atom:

$$E_n = -\frac{e^2}{n^2 8\pi\epsilon_0 a_H} = -\frac{13.598 \text{ eV}}{n^2} \quad (1)$$

$$n = 1, 2, 3, \dots \quad (2)$$

where  $a_H$  is the Bohr radius for the hydrogen atom (52.947 pm),  $e$  is the magnitude of the charge of the electron, and  $\epsilon_0$  is the vacuum permittivity, fractional quantum numbers:

$$n = 1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{p}; \quad p \leq 137 \text{ is an integer} \quad (3)$$

replace the well known parameter  $n = \text{integer}$  in the Rydberg equation for hydrogen

excited states. The  $n = 1$  state of hydrogen and the  $n = \frac{1}{\text{integer}}$  states of hydrogen are

nonradiative, but a transition between two nonradiative states, say  $n = 1$  to  $n = 1/2$ , is possible via a nonradiative energy transfer. Hydrogen is a special case of the stable states given by Eqs. (1) and (3) wherein the corresponding radius of the hydrogen or hydrino atom is given by

$$r = \frac{a_H}{p}, \quad (4)$$

where  $p = 1, 2, 3, \dots$ . In order to conserve energy, energy must be transferred from the hydrogen atom to the catalyst in units of

$$m \cdot 27.2 \text{ eV}, \quad m = 1, 2, 3, 4, \dots \quad (5)$$

and the radius transitions to  $\frac{a_H}{m+p}$ . The catalyst reactions involve two steps of energy

release [1, 13]: a nonradiative energy transfer to the catalyst followed by additional energy release as the radius decreases to the corresponding stable final state. Thus, the general reaction is given by:

$$m \cdot 27.2 \text{ eV} + \text{Cat}^{q+} + H \left[ \frac{a_H}{p} \right] \rightarrow \text{Cat}^{(q+r)+} + re^- + H \left[ \frac{a_H}{(m+p)} \right] + m \cdot 27.2 \text{ eV} \quad (6)$$

$$H \left[ \frac{a_H}{(m+p)} \right] \rightarrow H \left[ \frac{a_H}{(m+p)} \right] + [(p+m)^2 - p^2] \cdot 13.6 \text{ eV} - m \cdot 27.2 \text{ eV} \quad (7)$$

$$\text{Cat}^{(q+r)+} + re^- \rightarrow \text{Cat}^{q+} + m \cdot 27.2 \text{ eV} \quad (8)$$

And, the overall reaction is

$$H\left[\frac{a_H}{p}\right] \rightarrow H\left[\frac{a_H}{(m+p)}\right] + [(p+m)^2 - p^2] \cdot 13.6 \text{ eV} \quad (9)$$

$q$ ,  $r$ ,  $m$ , and  $p$  are integers.  $H^*\left[\frac{a_H}{(m+p)}\right]$  has the radius of the hydrogen atom

(corresponding to the 1 in the denominator) and a central field equivalent to  $(m+p)$

times that of a proton, and  $H\left[\frac{a_H}{(m+p)}\right]$  is the corresponding stable state with the radius

of  $\frac{1}{(m+p)}$  that of  $H$ . As the electron undergoes radial acceleration from the radius of

the hydrogen atom to a radius of  $\frac{1}{(m+p)}$  this distance, energy is released as

characteristic light emission or as third-body kinetic energy. The emission may be in the form of an extreme-ultraviolet continuum radiation having an edge at

$$[(p+m)^2 - p^2 - 2m] \cdot 13.6 \text{ eV} \left( \frac{91.2}{[(p+m)^2 - p^2 - 2m]} \text{ nm} \right) \text{ and extending to longer}$$

wavelengths. In addition to radiation, a resonant kinetic energy transfer to form fast  $H$

may occur. Subsequent excitation of these fast  $H(n=1)$  atoms by collisions with the

background  $H_2$  followed by emission of the corresponding  $H(n=3)$  fast atoms gives

rise to broadened Balmer  $\alpha$  emission. Extraordinary ( $>100$  eV) Balmer  $\alpha$  line

broadening is observed consistent with predictions [14-25].

It is therefore clear that the final Office Action's assertion that there is flaw in Applicant's reaction mechanism regarding the energy transfer of 27.2 eV from a

hydrogen atom to a catalyst must necessarily match the energy difference between the initial and final hydrogen energy levels is incorrect. For at least this reason, Applicant respectfully submits that the final Office Action's assertion as to utility is flawed, and therefore not tenable.

Applicant's derivations and use of well established classical physical laws are correct as validated by the attached independent review by Physics Professor Booker: "Report on the Evaluation of Chapter 1 in "The Grand Unified Theory of Classical Quantum Mechanics" by Dr. Randell L. Mills," Randy Booker, Ph.D., Department of Physics, UNC Asheville, January 11, 2009.

**C. The Office's position as to utility is also incorrect because the invention is operable as claimed**

Applicant also respectfully traverses the 35 U.S.C. § 101 rejection, because the invention is indeed operable and possesses utility. The plasma reactor recited in independent claim 1 and the method recited in independent claim 296 involve completely verifiable parameters. Nothing in the pending claims supports the final Office Action's assertion that the claimed invention is inoperative and, therefore, lacks credible utility.

In further rebuttal of the Office's position, Applicant respectfully directs the Office to the following evidence, which demonstrates the utility of the claimed invention. This evidence relates to BlackLight Power's power-generation technology, which is directly relevant to the claimed invention. Both the plasma reactor and the method recited in the present application use a hydrogen catalysis reaction (e.g., claim 1 recites "a plasma forming energy cell for the catalysis of atomic hydrogen . . ."). This evidence

further substantively rebuts the final Office Action's position that the claimed invention is not operable.

**i. The attached Press Release dated October 20, 2008, demonstrates that the claimed invention is operable and thus has specific and credible utility.**

First, Applicant refers the Examiner to the Press Release issued by BlackLight Power, Inc. (BLP) on October 20, 2008 (hereafter, "Attachment 1"). This Press Release announces the successful independent replication and validation of BLP's 1,000 Watt and 50,000 Watt reactors. See Attachment 1. The testing, performed by Dr. Peter M. Jansson of Rowan University, New Jersey, consisted of 55 tests of the 1,000 Watt and 50,000 Watt reactors over a nine-month period, including tests of controls and calibrations. See id. Over one megajoule of heat was generated in one test of the 50,000 Watt reactor, and heat generation was found to be proportional to the total amount of solid fuel used. See id. However, only one percent (1%) of the heat generated could be accounted for by previously known chemistry. See id. Dr. Jansson's test results agreed with the results of testing performed by BLP. Moreover, Dr. Jansson noted that the results of his testing "demonstrated that within the range of measurement errors," the significant heat generated, "which is 100 times the energy that could be attributed to measurement error, cannot be explained by other known sources like combustion or nuclear energy." Id.

**ii. Independent laboratory testing at Rowan University demonstrates that the claimed invention is operable and thus has specific and credible utility.**

Next, Applicant refers the Examiner to Dr. Jansson's report on the testing conducted at Rowan University, "Water Flow Calorimetry Experiments, Validation Tests



and Chemical Analysis of Reactants for BlackLight Power, Inc., Experiments and Analytical Testing Performed at Rowan University," September 2008 (hereafter, "Attachment 2"). Attachment 2 discloses results of the energy balance and materials characterization of the Raney Nickel (R-Ni) material tested. The known exothermic reactions of Raney Nickel (R-Ni) were considered for both the 1,000 Watt and 50,000 Watt reactors. Attachment 2, p. 10. Aluminum hydroxide ( $\text{Al}(\text{OH})_3$ ) present in R-Ni reacts exothermically (-325.1 kJ/mole  $\text{Al}(\text{OH})_3$ ) with sodium (Na) to form sodium hydroxide (NaOH), sodium aluminate ( $\text{NaAlO}_2$ ), sodium hydride (NaH), and hydrogen gas. This reaction is accompanied by the exothermic (-382.7 kJ/mole  $\text{Al}(\text{OH})_3$ ) reaction of aluminum hydroxide ( $\text{Al}(\text{OH})_3$ ) with aluminum metal (Al), present in the Raney Nickel, to generate aluminum oxide ( $\text{Al}_2\text{O}_3$ ) and hydrogen gas ( $\text{H}_2$ ). It was observed that both reactors generated more heat than could be accounted for from this pair of reactions by large factors, far greater than the analytical or energy measurement errors. The 1,000 Watt reactor generated 20 kiloJoules of excess heat, while the 50,000 Watt reactor generated 1.0 MegaJoules of excess heat. Id. at 12. As noted in Attachment 1, Dr. Jansson's team performed chemical analysis on these reactions, and the analysis could only account for one percent (1%) of the observed heat production. Id. From these results, Dr. Jansson concluded that "there is a novel reaction of some type causing the large exotherm which is consistently produced in our experimental runs" and that "[t]he past few months have shown great progress in our ability as an external team of scientists to reproduce many of the experiments that BLP scientists have achieved in their own laboratories." Id. at 11. Applicant predicts that NaH formed by these

reactions can form hydrinos with the release of about 50 MJ/mole H<sub>2</sub> that accounts for the excess heat observed.

**iii. Television coverage reflecting a licensing agreement between BlackLight Power and a power generation company demonstrates that the claimed invention is operable and thus has specific and credible utility.**

Finally, Applicant refers the Office to a television report broadcast by Cable News Network (CNN) on December 11, 2008 ("the CNN report"). The CNN report highlights BLP's licensing agreement with Estacado Energy of New Mexico, a utility company. This represents BLP's first licensing agreement for its technology. The CNN report is viewable on the Internet at the following URL:

<http://money.cnn.com/video/#/video/news/2008/12/11/news.energyfix.121108.cnnmoney>

**iv. Additional Evidence Previously Submitted demonstrates that the claimed invention is operable and thus, has specific and credible utility.**

In addition to the foregoing, the previously submitted report from Professor Booker of the Department of Physics at the University of North Carolina also provides validation of compounds in accordance with the present application. For example, pages 6-8 and Figures 4-5 show a large net reaction enthalpy resulting from BlackLight compounds. Calibration studies done before those experiments confirm that the heat measured cannot be attributed to experimental error or instrumental artifact. See Reference 3 at pages 3 and 4. Dr. Booker concludes that "Blacklight Power has discovered a novel new heat source, which produces a large excess of heat."

Applicant submits that, as exemplified by Attachments 1 and 2 and the CNN report, as well as prior evidence of record, there is more than sufficient and satisfactory

evidence to illustrate the operability of BLP's power generation technology. Although both Attachments 1 and 2 relate to heat-generating technology, the technology utilizes a hydrogen catalysis reaction, as recited in the presently pending claims. To that end, the heat produced illustrates the operability of, *inter alia*, the hydrogen catalysis reaction.

As a result, Applicant submits that this evidence demonstrates that the claimed invention is operable and possesses specific and credible utility. Applicant believes that it is simply improper for the Examiner to simply ignore all the evidence of record that rebuts the assertions related to lack of utility. For example, Applicant has shown through third party tests that the claimed reactor and method provides a large excess of heat. Rather than proffer an explanation of why the production of excess heat has a definite utility, the Examiner chooses to make the curious conclusion that "while these papers (referring to the reports of Drs. Booker and Jansson) report an anomalous amount of heat, anomaly alone is not sufficient evidence." Final Office Action at 4. Surely the Examiner cannot argue that the production of any heat, and certainly a large excess over what is expected, has a utility.

Applicant submits that in view of this evidence, the applied 35 U.S.C. § 101 rejection is improper, both for the reasons stated herein, and the reasons specified in the Request for Reconsideration filed July 21, 2008. Applicant therefore respectfully requests withdrawal of this rejection, and the full examination of the claims on the merits.

### **III. Response to Rejection under 35 U.S.C. § 112, ¶ 1**

The Office also continues to reject claims 1-316 under 35 U.S.C. § 112, ¶ 1, as failing to comply with the enablement requirement. Final Office Action at p. 2.

According to the final Office Action, "[t]he claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art . . . to make and/or use the invention." Id. From this absence of any articulation of the § 112, ¶ 1, rejection apart from the basis for the § 101 rejection traversed above, Applicant understands the final Office Action to mean that, because the claimed invention is allegedly inoperable and allegedly lacks utility, it is also not enabled by the Specification.

Applicant respectfully traverses this rejection for at least the reasons of record. In addition, Applicant traverses this rejection for the reasons stated above in response to the applied 35 U.S.C. § 101 rejection. Specifically, Applicant maintains that for the reasons detailed above and the reasons of record, the claimed invention is operable as claimed, and has specific and substantial utility. Furthermore, the fact that Applicant's claimed invention is operable and has utility directly rebuts the final Office Action's rationale for maintaining the applied 35 U.S.C. § 112, ¶ 1, rejection (i.e., that because the claimed invention is allegedly not operable, it is also not enabled).

With the above in mind, Applicant submits that because the invention is operable as claimed, it is *presumptively enabled*. That is, during examination, "[a]s a matter of Patent Office practice . . . a specification . . . must be taken as in compliance with the enablement requirement of the first paragraph of § 112 unless there is reason to doubt the objective truth of the statements contained therein which must be relied on for enabling support." In re Marzocchi, 439 F.2d 220, 223, 169 U.S.P.Q. 367, 369 (C.C.P.A. 1971). Here, Applicant clearly rebutted the "doubts" alleged by the Office, as demonstrated above and in the Request for Reconsideration filed July 21, 2008. Thus,

the burden remains on the Office to demonstrate *why* one of ordinary skill in the art would have been unable to make and use the claimed invention without undue experimentation.<sup>2</sup> Again, the Examiner improperly choose to simply ignore the rebuttal evidence showing how a proper analysis the Wands factors cut against the conclusion of non-enablement.

For at least the foregoing reasons and the reasons of record, Applicant submits that the 35 U.S.C. § 112, ¶ 1, rejection of claims 1-316 is improper. Applicant therefore requests withdrawal of this rejection, and the full examination of the claims on the merits.

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<sup>2</sup> In the Request for Reconsideration filed July 21, 2008, Applicant provided a detailed analysis of the factors set forth in In re Wands, 858 F. 2d 731, 737 (Fed. Cir. 1988), and explained how these factors support Applicant's position that the claimed invention is enabled. For the sake of brevity, this analysis is not reproduced herein, but rather incorporated by reference in its entirety.

#### IV. CONCLUSION

In view of the foregoing remarks, Applicant respectfully requests reconsideration of this application, and the timely allowance of the pending claims. Please grant any extensions of time required to enter this response and charge any additional required fees to Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,  
GARRETT & DUNNER, L.L.P.

Dated: April 20, 2009

By:   
Reece Nienstadt (Reg. No. 52,072)  
for Louis Troilo (Reg. No. 45,284)

**Attachments:** (1) Press Release issued by BlackLight Power, Inc. (BLP) on October 20, 2008; (2) "Water Flow Calorimetry Experiments, Validation Tests and Chemical Analysis of Reactants for BlackLight Power, Inc., Experiments and Analytical Testing Performed at Rowan University," September 2008; (3) "Report on a Scale-Up Water Flow Calorimetry Experiment at BlackLight Power," Randy Booker, Ph.D., Department of Physics, UNC Asheville, July 2, 2008; and (4) "Report on the Evaluation of Chapter 1 in "The Grand Unified Theory of Classical Quantum Mechanics" by Dr. Randell L. Mills," Randy Booker, Ph.D., Department of Physics, UNC Asheville, January 11, 2009.

**Appendix of References Cited in Response:**

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17. R. Mills, P. Ray, B. Dhandapani, W. Good, P. Jansson, M. Nansteel, J. He, A. Voigt, "Spectroscopic and NMR Identification of Novel Hydride Ions in Fractional Quantum Energy States Formed by an Exothermic Reaction of Atomic Hydrogen with Certain Catalysts", *European Physical Journal-Applied Physics*, Vol. 28, (2004), pp. 83-104.
18. R. Mills, K. Akhtar, B. Dhandapani, "Tests of Features of Field-Acceleration Models for the Extraordinary Selective H Balmer  $\alpha$  Broadening in Certain Hydrogen Mixed Plasmas", submitted.



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**Report on a Scale-up Water-Flow  
Calorimetry Experiment  
at BlackLight Power**

**by**

**Randy Booker, Ph.D.  
Department of Physics  
UNC Asheville  
July 2, 2008**

This report outlines results I obtained with a water flow calorimetry scale-up experiment when I visited Blacklight Power of Cranbury, New Jersey, from May 27-30, 2008. I was to validate the measurements for energy input and energy output for a new 50 KW system under study. The chemical reactions causing the extra energy output and the chemical reactants themselves were made known to me. I have seen the chemistry involved, and reports with the chemistry involved exist in my notes.

Of main importance to validate in these experiments were: the procedure used for carrying out the experiment, that the experiment was carried out correctly in front of an impartial validator (myself), and that the analysis of the energy input and energy output was sound. I was also able to validate the chemistry involved.

The protocol for the experiment was as follows:

1. Chemicals are loaded into the reaction cell and samples taken for chemical analysis.
2. Once the reaction cell is loaded inside the calorimeter, then the outer chamber enclosing the cell is evacuated and filled with near atmospheric helium. This procedure allows for a faster thermal stabilization of the system at the beginning.
3. The heating cycle is started by turning on the DC power supply. Then after that, the chamber is evacuated. This allows for a faster heating of the cell.
4. The heating cycle is continued until an exotherm (sudden rise in temperature) is observed in the cell temperature. At this point, the DC power supply heating is turned off.
5. Next, the vacuum pump valve is closed and the outer chamber is filled once again with near atmospheric helium. This procedure allows for faster cooling of the cell and also simulates our initial chamber condition.

These protocol procedures, steps 2 thru 5, allow an entire calorimetry experiment (from loading the cell into the outer chamber, to heating the cell, to the cooling of the cell) to take place in about one and a half days. This time is longer by about half a day than the time I observed for smaller similar cells, due to the larger cell size and larger amounts of chemicals used in this 50 KW reaction cell. This reaction cell is a scaled-up version of the smaller similar cells I've observed previously in October 2007 and March 2008.

6. Finally, the reactor cell was removed from the calorimeter. The pressure of the vessel was checked. Then the cell was evacuated and refilled with helium gas. The reactor cell was then opened in an inert and dry atmosphere glove box filled with Argon. Samples of the chemical products were removed from the reactor cell for further analysis.

Chemicals from the starting reactants and final products were analyzed. Chemical tests included mass spectroscopy, gas chromatography, temperature-programmed decomposition, powder X-ray diffraction spectroscopy, NMR, as well as other tests such as TOF-SIMS. The chemical analysis confirmed that the starting materials matched

published characterizations of the same materials and dihydrino in the  $1/4^{\text{th}}$  state was a major product. Chemical analysis of the products left over after the reaction allowed the determination of the maximum energy contribution from known reactants leading to the observed chemical products.

Each experiment began with the reaction cell being loaded into the outer chamber. The outer chamber is a cylinder with cooling coils wound around its length. In the cooling coils, water continually flows in order to absorb the heat from the reaction cell and the chamber. The calibration experiment was run with an empty reaction cell inserted into the outer chamber. A photo of the outer chamber is shown in Figure 1.

The outer chamber is 20 inches in length with a 10 inch outer diameter and 0.12 inch thickness. The copper tubing is made of 5/16 inch outer diameter copper tubing.

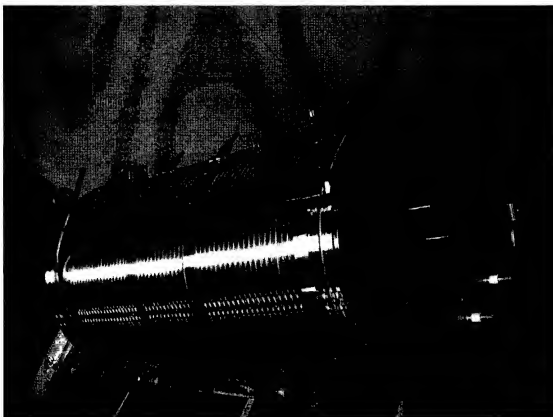
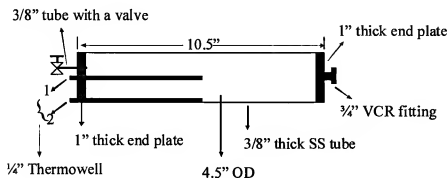


Figure 1. The Outer Cooling Chamber.

Two thermowells were inserted through the outer chamber and into the reaction cell in order to record the cell temperature. The output heat was measured by the formula  $mC_p\Delta T$ . In this formula,  $m$  is the mass of the water that flows, which depends on the flow rate of the water through the cooling coils, which is 1038 mL/min.

The heat capacity  $C_p$  is the heat capacity of water = 4.19.  $\Delta T$  is the change in the temperature of the water = (temperature of the water out) – (temperature of the water in). The two sets of high-precision thermowells were used to measure the inlet and outlet water temperatures. See Figure 2 for a schematic of the reaction cell used in these experiments.

Figure 2. Schematic of the scale-up cell



1 Center Thermowell

Cell Weight: 10 kg

2 Wall Thermowell

On day one and two (May 27-28, 2008), the experimental run with a reaction cell loaded with the Blacklight Power fuel was carried out. The amount of fuel used was 1 kg, which was comprised of a Raney-type nickel alloy and about 5 grams of solid fuel dopant. The solid fuel was comprised of hydrogen and a source of catalyst. It took about an hour to have the system stabilize to determine a good baseline. The heater was turned on and then the helium gas was pumped out of the outer chamber. The input energy was supplied by a DC power supply, supplying 800 W of power. This input power was verified by the formula  $\text{Power} = IV$  where  $I$  = current and  $V$  = voltage. The voltage of the DC power supply was 143.7 V and the current was 5.57 A, yielding a  $\text{Power} = (143.7 \text{ V})(5.57 \text{ A}) = 800.41 \text{ W}$ . We waited 30 minutes until a very sharp rise in the cell temperature was observed - what is known as an exotherm. Up until this point, the cell temperature had been climbing at a steady gently-sloping rate. The exotherm corresponded to a rapid rise in cell temperature, an almost vertical climb in cell temperature.

The exotherm for this fuel reaction cell experiment occurred at 75 °C as measured in the center of the cell. The center temperature rose from 94 °C to 441 °C in about 45 seconds. This process was short-lived, but intense. This very rapid temperature rise in the center of the cell is seen in Figure 3 below.

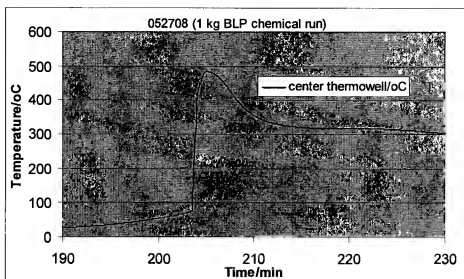


Figure 3

The exotherm for this solid fuel reaction cell experiment can also be seen to occur as measured by the wall thermistor. The wall temperature rose from 140 °C to 460 °C in about 4 minutes. This process was short-lived, but intense, as well. This rapid wall temperature rise is seen to occur at about 204 min in Figure 4 below.

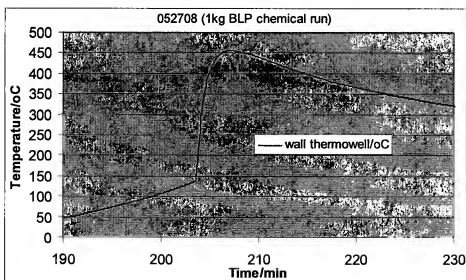


Figure 4

Blacklight Power (BLP) estimates that the thermal response equates to greater than 50,000 Watts or 50 kW of thermal power. After the exotherm, the input power was turned off and near atmospheric pressure helium gas was added to cool down the cell faster. The system was allowed to stabilize for about 20-24 hours in order to establish a thermistor offset value. The offset value was determined to be 0.0237. This value was used later to establish a good baseline for the energy measurements.

The input power and the output power curves are shown in Figure 5 for the experiment with the loaded fuel reaction cell. The purple curve represents the heat input into the cell and the blue curve indicates the heat flowing out of the cell. Notice that in Figure 5, once the peak has been reached, the output heating curve falls off in a very familiar exponential decay, as expected.

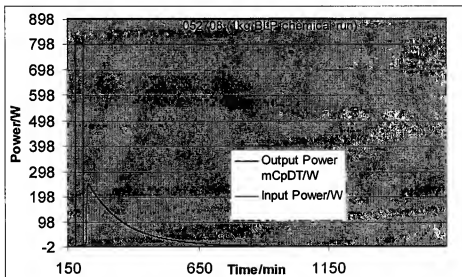


Figure 5

The input energy measured was 1448.05 kJ and the measured output energy was 2249.91 kJ. Thus excess heat was generated in this reaction. The excess heat generated is given by the difference in the output energy and the input energy, namely:

$$\text{Excess heat} = \text{Output energy} - \text{Input energy}.$$

The excess heat generated was 801.86 kJ for this scaled-up system. This corresponds to 55.38% of the input energy, a sizable amount of energy generated in this process.

I have confirmed that Blacklight Power is measuring the input and output heat correctly from the raw data tabulated from the fuel cell reaction experiment. This data was stored

into Excel spreadsheet files where it could be conveniently analyzed. The formula used is  $\text{Energy} = \text{Power} * \text{time} = \text{area under the input (or output) curve}$ .

On day two (May 28, 2008), after letting the system stabilize for about 20 hours since the end of the exotherm, we removed the reaction cell from the outer chamber. We set the reaction cell aside in an undisturbed place for chemical analysis on the morning of the third day. We then placed an empty reaction cell of the same dimensions and volume as on day one, but this time containing no Blacklight Power fuel, into the outer chamber and calorimeter to get ready for day three's calibration run.

On day three and four (May 29-30, 2008), a calibration run with an empty reaction cell containing no Blacklight Power fuel was carried out. It again took about an hour to have the system stabilize to determine a good baseline. The heater was turned on and then the helium gas was pumped out of the outer chamber. The input energy was again supplied by a DC power supply, supplying 800 W of power. The voltage of the DC power supply was 143.6 V and the current was 5.57 A, yielding a  $\text{Power} = (143.6 \text{ V})(5.57 \text{ A}) = 799.85 \text{ W}$ . We applied this input power for 30 minutes, the same amount of time as on day one when the exotherm occurred. This corresponded very closely to the same input energy as on day one. However, this time no exotherm and no sharp rise in the cell temperature was observed.

The temperature measured at the center of the reaction cell as a function of time is shown in Figure 6 below. While the heating cycle was on, the temperature at the center of the cell smoothly rose from 25°C to 230 °C, with no exotherm seen. Once the heating was turned off and near atmospheric pressure helium gas was introduced into the cell, the temperature at the center smoothly fell in an exponential manner, which was to be expected.

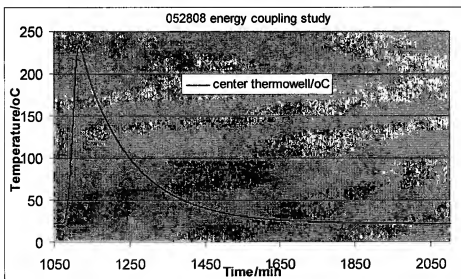


Figure 6



Also, the measurement of the wall temperature during the calibration experiment showed a similar behavior, as shown in Figure 7 below. During the heating cycle, the wall temperature of the reaction cell smoothly rose from 25°C to 245 °C, with no exotherm seen. Once the heating was turned off and near atmospheric pressure helium gas was introduced into the cell, the temperature at the wall also smoothly fell in an exponential manner, which again was to be expected.

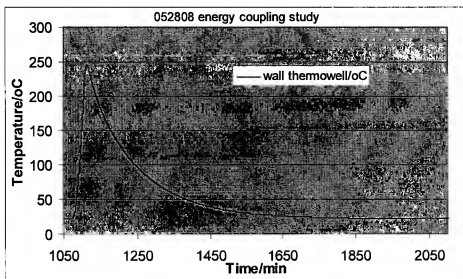


Figure 7

A measurement of the energy input and the energy output from the cell allows the coupling of the cell to be computed. This is the efficiency of the calorimeter – how well it collects the heat that was supplied to the cell during the heating cycle.

The input power and the output power curves are shown in Figure 8 below for the calibration experiment with the empty reaction cell. The purple curve represents the heat input into the cell and the blue curve indicates the heat flowing out of the cell.

The input energy measured was 1448.09 kJ, which was very close to the same input power supplied to the fuel reaction cell on day one (namely, 1448.05 kJ). During the calibration run, the output energy measured was 1454.85 kJ. This led to a difference in energy of 6.76 kJ. The calorimeter actually measured a little more energy than was supplied. Most of the time a calorimeter like this will measure less heat output and a typical energy coupling may be 98%, indicating that 98% of the energy supplied was actually collected as output heat.

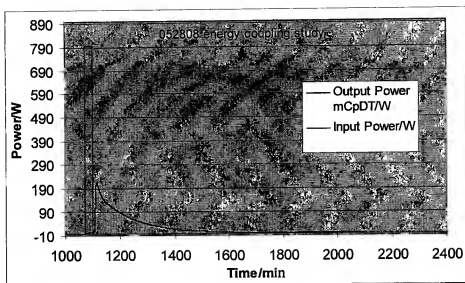


Figure 8

However, in this case the energy coupling = (Output Energy)/ (Input Energy) =  $1454.85/1448.09 = 100.47\%$ . In any real experiment, there is experimental error in reading the voltage of the power supply, the current of the power supply, the water flow rate, etc. We estimated that at most this experimental error would amount to  $\pm 1\%$ . So as long as the excess heat lies less than 1% for the calibration, then it is within the limits of experimental error. Here the excess is very slightly above 100%. It is only 0.47% above 100%, lying well within the limit of experimental error. The calibration experiment was a success and demonstrated that the calorimeter works very well. This calorimeter captures effectively 100% of the heat produced inside of it. At the most, only 1% of the heat will leak out of the cell (based on the  $\pm 1\%$  experimental uncertainty).

The input energy and output energy correspond to the area under each curve. I have confirmed that Blacklight Power is measuring the input and output heat correctly from the raw data tabulated from the calibration experiment. This data was stored into Excel spreadsheet files where it could be conveniently analyzed. The formula used is:  
 Energy = Power \* time = area under the input (or output) curve.

### Summary

Blacklight Power has discovered a novel new heat source, which produces a large excess of heat. This reaction was observed in the scale-up fuel reaction cell experiment using a water flow calorimeter. In that experiment 801.8 kJ of excess heat was generated. The observed excess heat reaction was brief yet intense. BLP estimates that this response equates to greater than 50,000 Watts or 50 kW of thermal power.

This 801.8 kJ is a sizeable increase in energy given that the heat of reaction of the reactants is at most 60 kJ. From the mass spectrometer, gas chromatograph, and X-ray diffraction analysis, plus TOF-SIMS and other diagnostic tests we ran on the pre- and post-samples from the scale-up fuel reaction cell, we have determined the chemistry involved in the fuel reaction cell. From this known chemistry, 60 kJ is the most exothermic these reactants would produce if merely chemically reacted (based on the amount of water and other chemicals present after the reaction cell was run). Other reactions involving the reactants are predominately endothermic, so 60 kJ is the maximum these reactants could produce exothermically. However, this new process produced 801.8 kJ, which is 13.4 times the heat of reaction of the materials. In other words, if the reactants merely underwent an ordinary chemical reaction, then they would release at the most 60 kJ of heat. However, here, with a new process occurring in the scale-up fuel cell, 13.4 times that much heat was released as a result of a new process. In addition, product molecular hydrids were identified by NMR that indicated that the excess heat is from their formation.

The calorimeter appears to function properly, as seen from the calibration experiment, where it was shown that the calorimeter captured effectively 100% of the heat from the heater – a very efficient calorimeter. Raw data files were checked and inspected to make sure that the input and output energies were being measured correctly in each experiment. These energies were confirmed as being measured correctly. Also, during the running of the actual experiments, I was allowed to observe the entire experiment from the loading of the cell into the outer chamber, to placing the outer chamber into its insulated external container, to taking the data, to asking questions about the procedure and the data taking, to observing the loading of the chemicals into the fuel cell in an inert and dry atmosphere glove box, to determining the chemistry that was taking place in the fuel cell. I wrote down numbers off of screens and displays while the experiments were running and I compared them to the numbers being collected by the computer with LabView. In all cases these numbers agreed. The water flow rate was measured by us by hand and compared to the value measured by the computer. Both numbers were in exact agreement.

I am led to the conclusion that the generation of the net excess heat in the solid fuel reaction cell experiment is real and reproducible. Plus, no excess heat or exotherm was detected in the calibration experiment. Once the Blacklight Power reaction occurred in the solid fuel cell experiment, the heater was turned off. So no extra heat was needed to keep the Blacklight Process going. This means that it exhibits, essentially, **an infinite gain**. In order to sustain the Blacklight Power reaction, all that is needed is for the fuel to be re-generated. No extra heat is needed to sustain the reaction once the reaction starts. This has significance, indicating that this reaction can be easily commercialized.

The results seen here are consistent with previous experiments I observed at Blacklight Power in October 2007 and March 2008. The reactions I observed in a smaller cell in October 2007 produced an excess energy output of 6-10 times the heat of combustion of the reactants. Likewise, the gains I observed in March 2008 in a smaller similar cell (6

times the heat of combustion of the reactants) were consistent with the gains I observed in October 2007. However, the reactants used in the fuel reactor cell in March 2008 are compounds that are able to be regenerated easily, whereas the reactants in the reactor cells used in October 2007 were not reactants that can easily be regenerated.

The scaled-up system I have observed in May 2008 is a larger version of the fuel reactor I observed in March 2008. This scaled up version produced  $801.8/10.8 = 74.2$  times as much energy output as the smaller reaction cell that I observed in March 2008. The chemistry was very similar in nature, but more chemicals were used, which resulted in a larger excess energy output in May 2008.



Water Flow Calorimetry Experiments, Validation Tests and  
Chemical Analysis of Reactants  
for BlackLight Power Inc.

Experiments and Analytical Testing  
Performed at Rowan University  
Glassboro, New Jersey

21 July – 24 September 2008

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**September 2008**

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## 1. Executive Summary

The company BlackLight Power (BLP) of Cranbury, NJ has been conducting experiments on the heat generation from materials which demonstrate what they believe is a proprietary process capable of relaxing the hydrogen atom below its normally considered ground state. For some time now, teams of engineering professors and their students at Rowan University have been involved in validating many of the heat experiments performed by BlackLight Power in our own campus laboratory facilities. The project described herein is the most recent continuation of previous calorimetry experiments which were completed over the last few months with the assistance of professors and students from the Chemistry and Biochemistry departments within the University. The findings which will be highlighted in this report indicate that the engineering experiments continue to evolve significant amounts of thermal energy (quite consistent with previous work) and the supplementing of this energy analysis by the chemistry team indicates that approximately 1% of the energy being observed as evolving in these experiments can be accounted for by known chemical reactions given the accuracy and details of our best analysis techniques. These results are given in this report. The work describes an initial test cell (containing 15 – 30 grams of BLP materials) as well as introduction of what BlackLight Power calls its '50kW Unit' which contains approximately 1.5 kg of BLP materials. Our teams have supplemented these thermal analyses with numerous calibration experiments to verify that the heat generated by the thermal 'heat' runs produce energy well in excess of the calorimeter's accuracy limits. For example – in the BLP 50-kW test unit the calibration runs indicated we were able to capture over 99% of the heat we generated electrically within the calorimeter (0.54-0.82% loss). In the actual heat experiments the calorimeter generated over 1.01-1.02 megajoules of excess heat of which only 9.4-11.0 kilojoules could be accounted for by our chemistry team. The combination and variety of testing by the chemistry team (TPD & XRD) generated results that characterized the primary compounds in the BLP materials and provided no evidence of other reactants, to the limit of the techniques used to characterize the samples. Therefore the team chose the most exothermic reactions that might occur to be as conservative as reasonable given the significant impact these findings represent. These reactions are provided in more detail in the following report and clearly indicate that these results are unexpected given conventional chemistry and may represent a validation the BLP scientists have indeed uncovered a novel technology for producing energy from the hydrogen atom.

The report is structured to provide an overview of the experiments conducted at Rowan University from July through September 2008 with an overview of the calorimetry results and a discussion of the energy analysis from the chemical investigation of the experiment reactants before and after each heat experiment was completed. This report is a summary of what has been completed in the last few months and should be read in conjunction with our previous report to enable the reader to have a clear understanding of the experimental set-up.



## 2. Rowan University Laboratory Setup

To prepare for the installment of the new cell, starting July 19 2008, the BLP setup was moved to a more secure laboratory which limited access beyond the security available in the Thermodynamics laboratory used during the 2007-2008 academic year. The fundamentals of the calorimeter, data acquisition system, water flow controller and refrigeration system are identical to the systems in our previous report, with a few exceptions. The changes for this project included the implementation of the larger cell (BLP 50 kW unit) and calorimeter as well as a UPS to ensure backup power in case of a power failure. During the scale-up tests an additional water pump calibrated to ~1 L/min flow was used. Further repairs and replacements of the equipment included: replacing the thermistors and thermocouples (to measure water and cell temperature respectively), replacing the refrigerator, replacing the insulation for the water hoses, obtaining a longer power cord for the Xantrex power supply, and adding an overhead crane for lifting and lowering the calorimeter. With the scaled up equipment, several calibrations along with a total of two heat runs have been performed and analyzed.

## 3. Rowan University Calibration & Testing of 1kW BLP Reactor

Before the scale-up to the larger cell, several calibration and heat runs for the smaller system were conducted. The experiments spanned from July 19<sup>th</sup> to August 15<sup>th</sup>. Table 1 provides the results for the calibrations completed during this time. During this period of calibrations, the flow rate was adjusted regularly to uphold the accuracy of the data analysis. This was done any time the equipment was moved within the workspace, (which happened only twice) and after parts of the equipment were replaced (e.g. thermistors).

Table 1: Rowan University Calibration Results from 7/19/08 to 8/15/08

Run	Date	Input (kJ)	Output (kJ)	Percent Difference	Coupling
1	6/19/08	99.9039	98.2605	1.6586 %	0.98355
2	6/20/08	127.3319	124.5056	2.2446 %	0.977804
3	6/24/08	121.9525	120.4193	1.2652 %	0.987428
4	6/25/08	156.5466	153.942	1.6778 %	0.983362
5	6/27/08	97.9168	95.6801	2.3107 %	0.977157
6	6/30/08	101.3561	100.3803	0.96731 %	0.990373
7	7/31/08	99.0255	98.510	0.52647 %	0.994794
8	7/31/08	118.9836	115.3498	3.1015 %	0.96946
9	8/4/08	150.3276	147.7541	1.72671 %	0.982881
10	8/4/08	130.1745	128.2853	1.4619 %	0.985487

The calibration runs highlighted an average coupling of 0.98, the amount of energy captured by the water coolant relative to the energy input to the calibration heater.

Thermal coupling for the 1-kW cell calibrations were in 96.9-99.5% range consistently. Table 2 provides the results for the two heat runs completed with the 1kW setup. These were fairly similar to heat runs reported previously by our experimental team in that they produced a significantly large amount of excess output energy when compared to the input energy. Figure 1 displays the result of the 1<sup>st</sup> 30g r-Ni, 1kW heat run. It can be observed that the additional heat generated exceeded the input energy by 20.4-20.8 kJ consistently, which is well in excess of any inaccuracy of the calorimeter for these input energy levels. An error of 2% maximum in the calorimeter would only account for 2.1-2.5 kJ. More importantly, the chemical analysis performed by our chemistry team here at Rowan University found that 0.11-0.13 kJ/g of r-Ni was the most energy that standard chemistry could account for, this would be 1.65-1.95 kJ which is 8-9 % of the energy evolved in the reactions. It was after our teams demonstrated consistency in experimental technique at our own laboratory that the decision was jointly made to provide a scaled up (50 kW) system in the Rowan University engineering lab.

File Edit View Window Help 11:00 AM 8/15/08

Run	Date	Input (kJ)	Output (kJ)	Percent Difference	Coupling
1	8/7/08	127.33	148.1229	15.0972 %	1.163299
2	8/15/08	104.6516	125.144	17.8353 %	1.195815

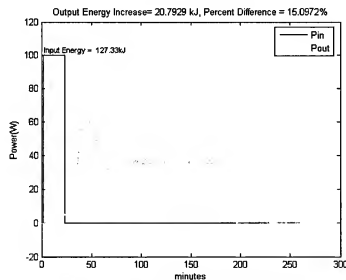


Figure 1. Input and output energy based on the results from the 1<sup>st</sup> 30g r-Ni, 1kW heat run.

#### 4. Rowan University Calibration – BLP 50 kW Reactor

The 50 kW system was calibrated before and after testing 1.5 kg of R-Ni. Example calibration results for the 50-kW reactor are displayed in Figures 2 and 3 below. Initial calibrations used a similar heating protocol to that of the experimental procedure, 800 watts were placed in the cell for 30 minutes totaling an input of 1440 kJ. The cell temperature for this calibration reached about 220° C. After testing the 1.5 kg of R-Ni, additional calibrations used a variable amount of energy to test for calorimetric consistency. Results for all calibration runs can be observed in Table 3. The statistical analysis from Figure 3 indicates that we have a consistent energy coupling across the entire data set.

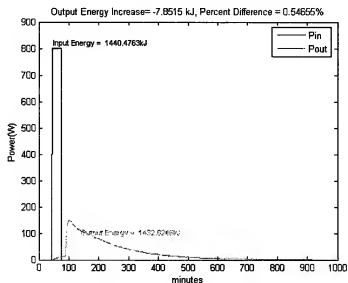


Figure 2: Power (W) vs. minutes graph showing Pin and Pout curves

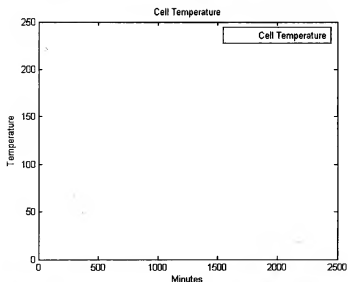


Figure 3: Cell Temperature vs. minutes graph showing Cell Temperature

Figure 3 Reactant BLP Sub Report (1) - Reactant Report

Run	Date	Input (kJ)	Output (kJ)	Difference (kJ)	Coupling
1	8/22/2008	1440.4763	1432.6248	-7.8515	0.994549
2	8/23/2008	1446.3437	1434.5521	-11.7916	0.991847
3	9/10/2008	1445.7316	1421.351	-24.3806	0.983136
4	9/11/2008	2735.197	2714.938	-20.259	0.992593
5	9/18/2008	1801.7422	1787.7645	-13.9777	0.992242
6	9/19/2008	2334.5454	2321.7293	-12.8161	0.99451
7	9/21/2008	1168.7181	1146.1633	-22.5548	0.980701
8	9/23/2008	909.4645	899.2298	-10.2347	0.988746

Based on the results, we were able to get calibration runs within 1% which further confirmed the calibration accuracy.

## 5. Rowan University Experimental Runs – BLP 50 kW Reactor

The result for a 50-kW experimental run is shown below. Using the same protocol as in all previous experiments (see previous report for detail), 800 watts was introduced into the cell for a period of time until a reaction between the BLP reactants caused an increase of heat to occur. Figure 4 showcases the immediate spike in the cell temperature. The temperature within the cell peaked a little over 850° C. Figure 5 displays the input and output energy of the heat run.

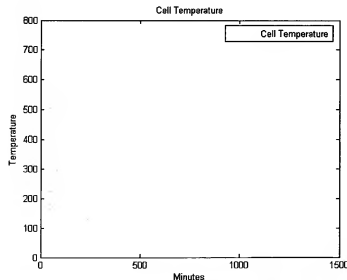


Figure 4 Cell Temperature of Rowan University 50 kW Experimental Run

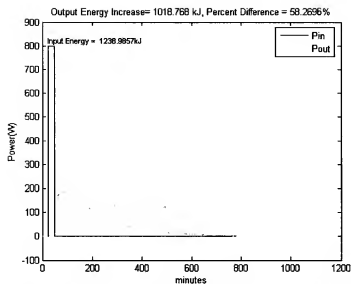


Fig. 12-2 Input and Output Power vs. Time for Experimental Run 1

Table 4 provides the complete results both heat runs. Both runs produced over 50 % excess heat, the range being 72.95-82.26% . The average coupling was 1.776.

Table 4. Coupling of two equal mass pyrolytic graphite rods, 150 g, 1.53 m, 1.53 m

Run	Date	Input	Output	Difference	Coupling
1	8/26/2008	1238.9857	2257.7537		1.82226
2	8/28/2008	1385.9453	2397.0085		1.729512

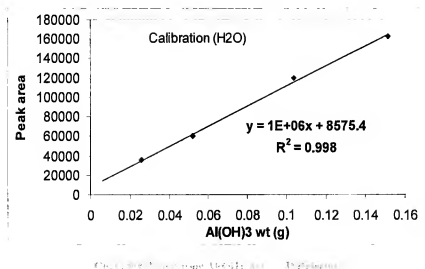
## 6. Chemical Analysis of Reactants for 1-kW and 50-kW Reactors

R-Ni is an industrial hydrogenation catalyst known to contain trace Gibbsite that decomposes to release water [1] The primary aim of the work by the Chemistry and Biochemistry Departments at Rowan University was to quantify the amount of water and hydrogen evolved when samples of R-Ni-155 and R-Ni-mix are subjected to high temperatures. We have also investigated the in-situ release of water and hydrogen from these samples and quantified their release by carefully studying their temperature programmed desorption (TPD) studies. The presence of foreign phases, if any, was investigated by carefully recording the powder x-ray diffraction (XRD) patterns. In what follows, we present the experimental studies that were carried out at our department.

Determination of water in R-Ni-155 and R-Ni-mix using temperature programmed desorption (TPD)

The analysis was done using a Chembet 3000 chemisorption unit of Quantachrome corporation with a Thermal conductivity detector (TCD). The initial task of this part of the work was to identify the proper conditions for the experiment. In an effort to identify the suitable carrier gas for desorption studies, helium, nitrogen and argon gases were employed. From these studies we conclude that argon was the best choice since it gave a responsive peak for both water and hydrogen. In our next batch of experiments, we employed both liquid nitrogen and dry ice for the separation of water [by condensation] during the course of chemisorptions experiments. Dry ice was chosen based on, a) its effectiveness to preferentially condense water and b) not freeze the carrier gas Argon or the hydrogen. The samples were heated at a rate of 5°C/min to 600 °C employing Ar as the carrier gas.

In the first phase of these investigations, we have carried out the calibrations required for the quantification of the evolved gases. A calibration plot for the release of water was obtained using Gibbsite ( $\text{Al}(\text{OH})_3$ ), since it is well known that it decomposes thermally to aluminum oxide and water at higher temperatures. We have also carried out the thermo-gravimetric study of Gibbsite to verify this assumption. For the TPD studies, different pre-determined amounts of Gibbsite were weighed and loaded into the sample chamber for the analysis of the water content. The peak area (obtained by integrating the peak), as shown below [Figure 11], scaled linearly with the amount of water evolved.



Following the calibration studies, samples of R-Ni-155 and R-Ni-mix were run (see Figure 13a and 13b in the Appendix section) and the peak areas obtained were plugged into the calibration equation to estimate the amount of water released. This allowed us to determine precisely the amount of gibbsite, if present, in these samples.

### Determination of H<sub>2</sub> in R-Ni-155 and R-Ni-mix

Quantification of hydrogen in R-Ni-155 and R-Ni-mix was performed using Chembet 3000. For the calibration of the instrument for hydrogen release, we employed MgH<sub>2</sub> as the source of hydrogen and studied the release of H<sub>2</sub> from this compound up to 600°C. The calibration plot for the H<sub>2</sub> release is shown below [see Figure 12]. Employing a procedure similar to the one described for water, peak areas of R-Ni-155 and R-Ni-mix were related to the hydrogen released.

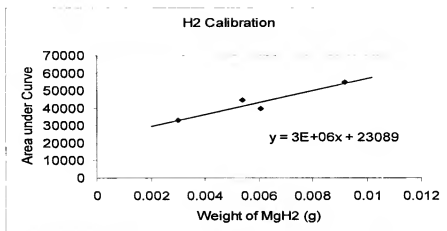


Figure 12. H<sub>2</sub> Calibration Curve for MgH<sub>2</sub>

### Summary results of H<sub>2</sub>O and H<sub>2</sub> from R-Ni-155 and R-Ni-mix.

The results indicate that 0.1121g of R-Ni-155 gave an amount of water equivalent to the presence of 2.953 mg of Al(OH)<sub>3</sub>; this translates to ~2.6% of Al(OH)<sub>3</sub> or  $5.07 \times 10^{-4}$  mole H<sub>2</sub>O/g in the sample. It also gave an equivalent amount of H<sub>2</sub> as 7.02mg of MgH<sub>2</sub> that translates to  $2.383 \times 10^{-3}$  mole H<sub>2</sub> /g of sample or 53.4 ml H<sub>2</sub>/g at STP. 0.1326g of R-Ni-mix gave an equivalent amount of water as 0.197mg of Al(OH)<sub>3</sub>, that translates to 0.15% of Al(OH)<sub>3</sub> or  $2.86 \times 10^{-5}$  mol H<sub>2</sub>O/g in this sample. It also gave an equivalent amount of H<sub>2</sub> as 9.75mg of MgH<sub>2</sub> that translates to 2.79 mmol H<sub>2</sub>/g or 62.5 ml H<sub>2</sub>/g at STP. Decomposition of Gibbsite is an endothermic reaction  $2\text{Al}(\text{OH})_3 \rightarrow \text{Al}_2\text{O}_3 + 3 \text{H}_2\text{O}$   $\Delta H = 92.45 \text{ kJ/mole}$  and responsible for the water given off.

### Characterization using XRD

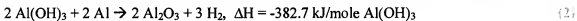
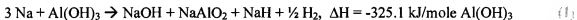
In this part of the work, we have carried out several long duration XRD scans of R-Ni-155 and R-Ni-mix samples, as well as post run samples from the Rowan engineering team. Diffraction patterns were recorded using Scintag X2 Advanced Diffraction System with an operating voltage set to 45 kV and current of 40 mA. Patterns were recorded in a step mode [0.02 Deg/min] in the 2 $\theta$  range 10-70 using a residence time of 8 seconds. The diffraction patterns of some of the samples are shown in the Appendix. Clearly, none of these samples showed the presence of crystalline impurities, including Gibbsite, and all the peaks can be related to the Ni-Al phase

(Raney Nickel). From these studies, we rule out the possibility of the presence of crystalline impurities in excess of 3%.

#### Energy related discussion

The combination of testing results provided no evidence of other reactants, to the limit of the techniques used to characterize the samples; therefore we chose the most exothermic reactions that might occur based on observation of water generation upon heating and an assumption that aluminum hydroxide is in the starting material according to the known composition of R-Ni [1].

If we consider exothermic reactions 1 and 2 given below, it is possible to estimate the energy accompanying the reactions observed.



#### a. 30 g - Energy Tests

From earlier calculations 2.6 wt%  $\text{Al}(\text{OH})_3$  (equivalent to 0.507 m.mol  $\text{H}_2\text{O/g}$  R-Ni-155), and assuming the exothermic reactions given by Eqs. (1) and (2) we estimate

$$\Delta \text{H} = -0.11 \text{ KJ/g R-Ni and } \Delta \text{H} = -0.13 \text{ kJ/g R-Ni, respectively.}$$

#### b. 1.5 kg - Energy Tests

For 0.15 wt%  $\text{Al}(\text{OH})_3$  (equivalent to  $2.86\text{E-}05$  moles  $\text{H}_2\text{O/g}$  R-Ni-mix), the exothermic reaction given by Eqs. (1) and (2) gives:

$$\Delta \text{H} = -6.25\text{J/g R-Ni and } \Delta \text{H} = -7.36\text{J/g R-Ni, respectively.}$$



## 7. Conclusions and Future Plans

Based on the results achieved by the Rowan University scientific teams from the BLP 1 kW and 50- kW reactors we have concluded that there is a novel reaction of some type causing the large exotherm which is consistently produced in our experimental runs. The past few months have shown great progress in our ability as an external team of scientists to reproduce many of the experiments that BLP scientists have achieved in their own laboratories. The current scientific team has grown competent in the experimental protocols and become more familiar with performing the experimental and the data analysis with consistent results. We are confident that the energy released from the BLP experiments can be replicated in laboratories at other scientific and educational establishments.

Our future plans include moving the project to the new South Jersey Technology Park during October 2008. We intend to continue further testing from October 2008 – May 2009. Based on the success of our calibration tests, we will continue with flow rate calibrations prior to and after each calibration/ heat run to assure we have more consistent and repeatable data. A constant record of each offset for each run will be kept as a reference for reanalyzing previous data. This step in the analysis assures we can minimize inaccuracies. We are confident that our team will be able to continue to replicate BLP experimental projects off site and are grateful for the assistance of BLP scientists as we have learned much from them in the accurate measurement and reliable measurement of the heat generated by their novel process.

## 8. Short Summary

Rowan Scientists confirmed BLP's 1 kW and 50 kW power source tests corresponding to 20 kilojoules and 1.0 megajoules respectively. Chemical analysis of the reactant and product R-Ni powder could account for less than 1% of the observed energy from known chemistry.

## 9. Appendix

The data which follows was generated by the Rowan University Departments of Chemistry and Biochemistry and are referred to in the text of the primary report.

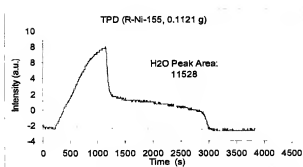


Figure 13 (a) H<sub>2</sub>O curve from R-Ni-155 TPD.

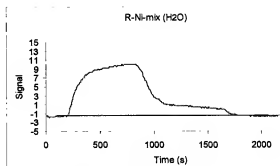
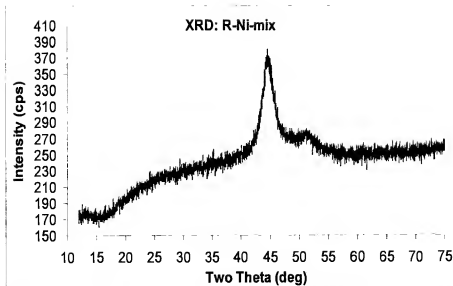
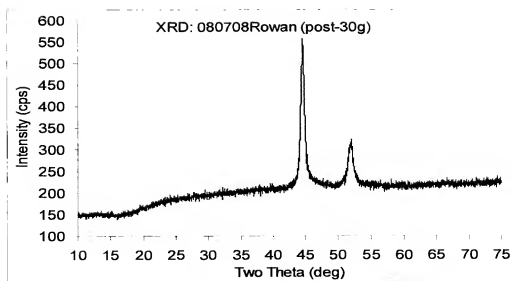
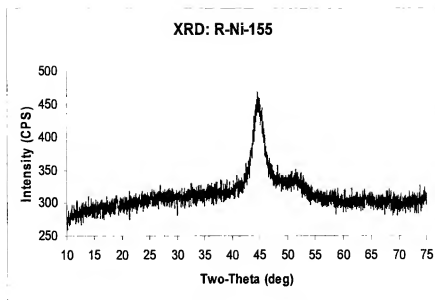
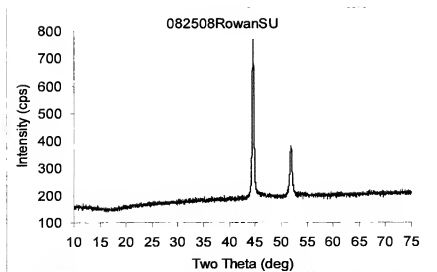
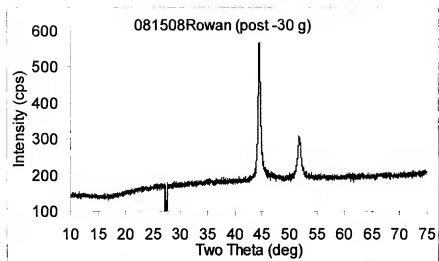


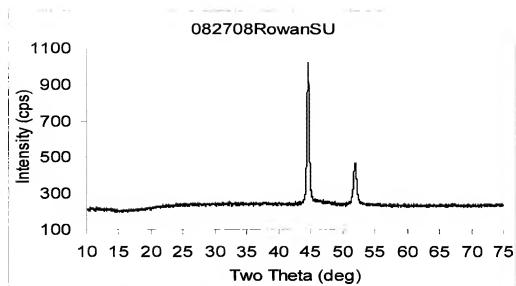
Figure 13(b) H<sub>2</sub>O curve from R-Ni-mix TPD

XRD Diffraction patterns (~10 hour scans) of Pre-reaction: R-Ni-155, R-Ni-mix.  
Post-reaction: 080708Rowan, 081508Rowan, 082508RowanSU, 082708RowanSU









**Report on the Evaluation  
of Chapter 1  
in  
“The Grand Unified Theory of  
Classical Quantum Mechanics”  
by Dr. Randell L. Mills**

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January 11, 2009

## Executive Summary

In my analysis, I conducted calculations on the Lande g-factor of the electron. I also replicated calculations leading to the values found in Tables 1.2, 1.3, 1.4, and 1.5 in the book "The Grand Unified Theory of Classical Quantum Mechanics" by Dr. Randell L. Mills. In the course of these calculations, I replicated all of his results in these tables, to a very high degree of accuracy. I also verified many of the equations he used in Chapter 1

## Purpose

The physics being modeled here are two-fold. First, the Lande g-factor for the electron is calculated. Then the Lande g-factor for the muon is calculated. These are characteristic numbers that are fundamental to the make-up of these particles. They also play an important role in calculating spin-flip transitions going from a spin-up state to a spin-down state. The spin-flip transition can be considered to involve a magnetic moment g times that of a Bohr magneton,  $\Delta E = g\mu_B B$ .

Secondly, quantities associated with one-electron atoms are calculated. This is a very important class of atoms to understand. Any correct theory of quantum mechanics must start here and show that it can calculate these results. The Bohr model of the atom excelled at describing one-electron atoms.

## Calculation

From CQM, the g/2 factor for the electron is given by Equation 1.195:

$$g/2 = 1 + \alpha/2\pi + (2\alpha^2/3)(\alpha/2\pi) - (4/3)(\alpha/2\pi)^2$$

I used the value for  $\alpha^{-1}$  found after Equation 1.195, namely 137.0360411. When I used this value in Equation 1.195, I found g/2 to be

$$g/2 = 1.001\,159\,652.$$

This compares very well with the CQM value of 1.001 159 652 120 shown in Equation 1.196. This is also in excellent agreement with the experimental value of 1.001 159 652 188(4) quoted in Equation 1.197.

I also used Equation 1.171 to calculate  $\alpha$  (using the values given in Equations 1.198-1.201 for  $\mu_e$ , e, c, and h) and found  $\alpha^{-1}$  to be 137.0360382, which is exactly the value quoted in Equation 1.202. Using this value of  $\alpha^{-1}$  in Equation 1.195, I found g/2 equal to 1.001 159 652, which is in agreement with the value shown in Equation 1.203, namely 1.001 159 652 137. Again this is in excellent agreement with the experimental value of g/2 given in Equation 1.204 of 1.001 159 652 188(4).

Next I wanted to replicate the values given in Table 1.2, calculated parameters for the hydrogen atom ( $n = 1$ ). Here are my results:

Parameter	Mills' Value	My Value
Radius	$5.2947 \times 10^{-11} \text{ m}$	$5.2948 \times 10^{-11} \text{ m}$
Potential Energy	-27.196 eV	-27.197 eV
Kinetic Energy	13.598 eV	Same as Mills
Angular velocity	$4.1296 \times 10^{16} \text{ rad/s}$	$4.1293 \times 10^{16} \text{ rad/s}$
Linear velocity	$2.1865 \times 10^6 \text{ m/s}$	$2.186499 \times 10^6 \text{ m/s}$
Wavelength	$3.325 \times 10^{-10} \text{ m}$	$3.3267 \times 10^{-10} \text{ m}$
Spin quantum number	$\frac{1}{2}$	Same as Mills
Moment of inertia	$1.277 \times 10^{-51} \text{ kgm}^2$	Same as Mills
Angular kinetic energy	6.795 eV	6.796 eV
Angular momentum mag.	$1.0545 \times 10^{-34} \text{ Js}$	$1.0546 \times 10^{-34} \text{ Js}$
Projection of the ang. Mom.	$2.636 \times 10^{-35} \text{ Js}$	Same as Mills
z-axis proj. of ang. Mom.	$5.273 \times 10^{-35} \text{ Js}$	Same as Mills
Mass density	$2.589 \times 10^{-11} \text{ kg/m}^2$	$2.586 \times 10^{-11} \text{ kg/m}^2$
Charge density	$4.553 \text{ C/m}^2$	$4.548 \text{ C/m}^2$

The agreement here is very close indeed, except for the last entry.

I also replicated the values given in Table 1.3, for one-electron atoms. All of my  $r_1$  values exactly agreed with those in Table 1.3. Here's my other results (all units are in eV):

KE (Mills)	KE (my value)	PE (Mills)	PE (my value)	Ionization E. (Mills)	Ionization E. (my value)
13.61	Same	-27.21	Same	13.61	Same
54.42	Same	-108.85	Same	54.42	Same
122.45	Same	-244.90	-244.91	122.45	Same
217.69	217.70	-435.39	Same	217.69	217.7
340.15	Same	-680.29	-680.30	340.15	Same
489.81	489.82	-979.62	-979.63	489.81	489.82
666.68	666.69	-1333.37	-1333.39	666.68	666.69
870.77	870.78	-1741.54	-1741.57	870.77	870.78

Again, the agreement is extremely good.



Next, I replicated the values given in Table 1.4, for one-electron atoms.

R <sub>1</sub> (Mills) (a <sub>0</sub> )	R <sub>1</sub> (me) (a <sub>0</sub> )	Ang. Vel. (Mills)	Ang. Vel. (me)	Linear Vel. (Mills)	Linear Vel. (me)	Wave length (Mills)	Wave Length (me)
1.000	Same	0.413	Same	2.19	Same	3.325	3.321
0.500	Same	1.65	Same	4.38	4.37	1.663	1.661
0.333	Same	3.72	Same	6.56	Same	1.108	1.109
0.250	Same	6.61	Same	8.75	Same	0.831	Same
0.200	Same	10.3	Same	10.9	Same	0.665	0.667
0.167	Same	14.9	Same	13.1	Same	0.554	0.555
0.143	Same	20.3	20.2	15.3	Same	0.475	Same
0.125	Same	26.5	26.4	17.5	Same	0.416	Same

Here, again, the agreement is excellent.

I verified all of the entries in Table 1.5. I got the exact values for all the entries in the column of  $\beta$  values. I also got the exact values for all the entries in the last column, namely, the Relative Difference between Experimental and Calculated. My values for the Theoretical Ionization Energies were remarkably close to the values reported in the CQM book. They were all close enough for me to be convinced they were right, usually differing only in the last one or two decimal places – a very small difference, actually. There were only two values that were the farthest off. For  $Z=21$ , the Mills' book gets 6035.681 and I got 6035.520, and for  $Z=25$ , the Mills' book gets 8575.426 and I got 8575.229. All the rest of the values for the Theoretical Ionization Energies agreed very closely.

I have verified that equations 1.5 and 1.9-1.11 are valid equations.

I have also verified that equations 1.32, 1.35, 1.36, and 1.37 are valid and yield the results listed.

Also I have verified that equations 1.38, 1.41, 1.43, 1.44, and 1.45 are valid equations.

I have also verified that equations 1.46, 1.47, and 1.52-1.55 are correct.

I have also shown that equations 1.56, 1.57, 1.59, and 1.62-1.64 are correct as well.

Likewise, equations 1.66, 1.67, and 1.69 are valid.

I have also shown that equation 9 of Box 1.1, and equations 1.84-1.85 are correct and yield the values listed in the CQM book.

Equations 1.96 and 1.97 are correct as well and give the values listed in the book.

Likewise, equations 1.98, 1.102, 1.104, 1.105, and 1.107 are correct and yield the values listed in the book.

Equations 1.110, 1.112, 1.17, 1.118, and 1.120 are also found to be correct as stated.

Equations 1.121, 1.127-1.129 are also valid equations.

In Box 1.2, I have verified that equations 2, 4, 5, 12, 15, 16, 22-25, 28, 31, 33, and 34-35 are valid and true.

I have also shown that equations 1.133 and 1.135-1.136 are correct as written.

Equations 1.142-1.148 are also correctly written, as are equations 1.150-1.152.

I have shown that equations 1.154-1.161 are correct.

Also, equations 1.163, 1.166, 1.167, 1.169-1.179 are correct as stated in the book.

I have also verified that equations 1.181, 1.182, 1.187-1.189, 1.192-1.193, 1.195-1.196, and 1.202-1.203 are also valid equations, and yield the results listed from their calculations.

I have also show that equations 1.212-1.215 are correct, as are equations 1.218, 1.221-1.229, and 1.231. These equations are correct as listed and yield the values listed which result from the calculations involving these equations.

Equations 1.232-1.233 are correct as well, as are equations 1.243 and 1.245.

Equations 1.250-1.254 are valid as well, as are 1.256-1.259.

## **Conclusion**

I successfully verified the values of the one-electron quantities in Tables 1.2, 1.3, 1.4, and 1.5. Furthermore, I was able to verify the QM value for the Lande g factor for the electron. I successfully verified many of the equations and calculated quantities listed in Chapter 1, as well. I consider this to be validation of the QM theory in Chapter 1.

FOR IMMEDIATE RELEASE

## NEWS RELEASE

### **BlackLight Power Inc. Announces Independent Replication of New Energy Source**

*Rowan University confirms BlackLight's new disruptive energy source*

**Cranbury, NJ (October 20, 2008)**—BlackLight Power (BLP) Inc. today announced the successful independent replication and validation of its 1,000 watt and 50,000 watt reactors based on its proprietary new clean energy technology.

BLP's 50,000 watt reactor generated over 1 million joules of energy in a precise measurement made by Rowan University engineers, led by Dr. Peter Jansson. The independent study included full characterization of a proprietary solid fuel to generate the energy before and after the reaction.

"Our experiments on the BlackLight technology have demonstrated that within the range of measurement errors the significant energy generated, which is 100 times the energy that could be attributed to measurement error, cannot be explained by other known sources like combustion or nuclear energy," says Dr. Jansson, professor of engineering at Rowan University. "The ability to generate such tremendous power in this controlled process demonstrates that the claim by BlackLight Power that it is able to demonstrate repeatable heat experiments based on their technology can be replicated by independent scientists."

The BLP process continues to be replicated and validated by independent scientists and has received interest from financial institutions and power utility plant operators around the world. BLP plans on licensing its technologies.

"This is the result that the world has been waiting for to engage this technology and provides validation that the energy generated using the BlackLight technology is no

longer an academic argument.” says Randell Mills, Chairman, CEO, and President of BlackLight Power Inc. “The BlackLight Process generates more than 200 times the energy of burning hydrogen that can be harnessed to replace the thermal power in coal, oil, gas and nuclear power plants. These experimental results prove that the new power source discovered in our labs has the possibility to make a profound impact in our current energy-strapped economy.”

Dr. Jansson’s team conducted 55 tests of the prototypes, including controls and calibrations, during a nine-month study. Test results indicated that energy generation was proportional to the total amount of solid fuel, and only one percent of the one million joules of the energy released could be accounted for by previously known chemistry. These results matched earlier tests conducted at BlackLight’s R&D center, in Cranbury New Jersey.

Michael Jordan, former CEO of Westinghouse and current board member of BlackLight Power, says “the offsite replication and independent testing announced by Dr. Peter Jansson and his team of scientists underscore the business viability and impact of BlackLight’s new energy source as the opportune replacement of coal-based fuels and will go down as one of the most important advances in the field of energy in the last fifty years.”

Rowan University’s Dr. Jansson has released a report outlining the full documentation and results of the off-site replication and independent testing of the BlackLight Process that is available at: <http://www.blacklightpower.com/>

BlackLight Power is committed to announcing all future progress as it occurs.

#### **About BlackLight Power**

BlackLight Power Inc. is the inventor of a new primary energy source and a new field of hydrogen chemistry with broad commercial applications.

BlackLight Power has invented a new primary energy source with applications to heating, distributed power generation, central power generation, and motive power based on a new chemical process of releasing the latent energy of the hydrogen atom, the BlackLight Process.

For more information, please visit <http://www.blacklightpower.com/>

#### **About Rowan University**

Rowan University, Glassboro, N.J., is a highly ranked comprehensive public university that offers bachelor's through doctoral degrees. The University comprises seven colleges: Business, Communication, Education, Engineering, Fine & Performing Arts, Liberal Arts & Sciences, and Professional & Continuing Education. U.S News & World Report ranks Rowan's College of Engineering 12th in the nation among programs that offer bachelor's and master's degrees.

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